Imprecise-Chance Markov Chains

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Both heat and cold for two reasons accelerate chemical and physical deterioration. The physical properties of components are modified by temperature and the component failure rate doubles for every 10°C rise in temperature. In electronic design, because of aging effect and stress (e.g., dynamic, electrical, thermal), the failure rate of component changes with time. Moreover, failure rates calculated in accordance with MIL-HDBK-217 do not normally address circuit failures caused by stress and aging effects, which result in fuzzy flow-rate equation system that can be associated with specified chance. Thus, to deal with such situtaion, we propose fuzzy flow-rate equation system. The specified chance represents possibility that flow-rate equation lies within specified interval. The interval may vary for the states because of aging effect and stress. Moreover, due to uncertain and time varing component failure rate, the chance is expressed by interval method. This approach presents flow-rate equation system of Markov model with fuzzy operand associated with specified interval chance that is so-called imprecise-chance equation system. To solve the imprecise-chance flow-rate equation system, we proposes the use of mathematical model obtained by developed approach to convert the equations to non-fuzzy mathematical model, that can be solved by software packages like LINGO. The model maximizes the possibility of sum of all probabilities, which results in obtaining the state probabilites, availability, and down time

of system. The application of the method is demonstrated by solving cooling unit Markov model for switching box used in telecommunication.